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IS 4131 (1967): Nickel copper alloy castings [MTD 8: Copper and Copper Alloys]



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*Indian Standard*  
SPECIFICATION FOR  
NICKEL-COPPER ALLOY CASTINGS

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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR NICKEL-COPPER ALLOY CASTINGS

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# *Indian Standard*

## SPECIFICATION FOR NICKEL-COPPER ALLOY CASTINGS

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 5 June 1967, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** There are many items of equipment used in chemical, petroleum, textile, paper, food and fertilizer industry, such as parts of pumps and valves where a high degree of corrosion resistance to acids, alkali and salts is called for. For these purposes, castings in nickel-copper alloy are generally used, especially in cases where even chromium-nickel stainless steels are not considered adequate as regards corrosion-resistance. Nickel-copper alloy castings are also used for steam valve trim for marine and industrial purposes. The alloy containing not more than 1.2 percent silicon is non-ageing at steam temperatures upto 427°C and is suitable for valve bodies, unsupported valve lids, etc. It has excellent resistance to softened boiler feed waters. Cast nickel-copper alloy with silicon above 2.5 percent is generally used where high degree of gall and wear resistance is required.

**0.3** This standard contains a number of clauses in which the purchaser is allowed to exercise an option and also call for an agreement between the purchaser and the supplier. The relevant clauses are listed below ( *see also* Appendix A ).

Clauses 3.1, 7.1, 8.1 and 10.1.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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### 1. SCOPE

**1.1** This standard specifies the chemical composition and mechanical properties of two types of nickel-copper alloy castings — namely NiCu31Mn1Si1Fe and NiCu29Mn1Si3Fe ( *see* 3.1 ).

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\*Rules for rounding off numerical values ( *revised* ).

## 2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of nickel-copper alloy castings shall be as laid down in IS : 1387-1959\*.

## 3. CHEMICAL COMPOSITION

3.1 The chemical composition of the castings when analysed in accordance with a method† mutually agreed to between the purchaser and the supplier shall be as follows:

<i>Composition</i>	<i>NiCu31Mn1Si1Fe</i>	<i>NiCu29Mn1Si3Fe</i>
Nickel ( including cobalt ), percent	63.0 to 68.0	63.0 to 68.0
Iron, percent	3.0 <i>Max</i>	3.0 <i>Max</i>
Manganese, percent	0.5 to 1.5	0.5 to 1.5
Silicon, percent	0.5 to 1.2	2.5 to 3.0
Carbon, percent	0.3 <i>Max</i>	0.12 <i>Max</i>
Sulphur, percent	0.06 <i>Max</i>	0.05 <i>Max</i>
Lead, percent	0.005 <i>Max</i>	0.005 <i>Max</i>
Other elements, percent	0.5 <i>Max</i>	0.5 <i>Max</i>
Copper, percent	Remainder	Remainder

## 4. MECHANICAL PROPERTIES

4.1 When tested in accordance with IS : 2654-1965‡ the tensile properties of test pieces prepared as specified in 4.2 shall be as follows:

	<i>NiCu31Mn1Si1Fe</i>	<i>NiCu29Mn1Si3Fe</i>
Tensile strength, kgf/mm <sup>2</sup> , <i>Min</i>	36.5	52.0
Yield stress, kgf/mm <sup>2</sup> , <i>Min</i>	17.5	28.5
Elongation on $5.65 \sqrt{S_0}$ ( Gauge length ), percent, <i>Min</i>	16.0	8.0
Hardness, HV ( for guidance only )	105 to 155	185 to 240

4.2 The test bars shall be of suitable size for turning to the following dimensions of tensile test piece. They shall be cast separately in moulds of the same material as that used for the castings which they represent.

\*General requirements for the supply of metals and metal products.

†Indian Standard is likely to be formulated.

‡Method for tensile testing of copper and copper alloys.



The number of test samples required shall be in accordance with 9.1 and Appendix B.

Gauge length, mm	50
Parallel length, mm	56
Diameter, mm	10
Cross-sectional area, mm <sup>2</sup>	78.5

## 5. WORKMANSHIP

5.1 The castings shall be accurately moulded in accordance with the pattern or working drawing supplied by the purchaser.

## 6. FREEDOM FROM DEFECTS

6.1 The castings shall be clean, sound and free from blow-holes. Defects shall not be repaired unless permission in writing has been obtained previously from the purchaser.

## 7. POROSITY TEST

7.1 If the purchaser requires castings to be tested for porosity, he shall state this in his enquiry and order. The nature of the test, the test pressure, the testing fluid, the number of samples, method of drawing the sample and criteria for conformity shall also be the subject of agreement between the manufacturer and the purchaser.

## 8. SIZE AND SHAPE

8.1 The dimensions of the casting shall be in accordance with the drawing supplied by the purchaser. All surfaces marked for machining shall have sufficient allowance for that purpose but this shall not be excessive resulting in considerable amount of machining, and unnecessary increase in the weight of the casting. For those surfaces which are not to be machined, the sectional thickness shall not exceed by more than 5 percent of the specified thickness or by 2 mm, whichever is more unless specified otherwise by the purchaser.

## 9. SAMPLING AND CRITERIA FOR CONFORMITY

9.1 Unless otherwise required by the purchaser, the procedure for sampling and criteria to ensure conformity to the requirements of this specification shall be as given in Appendix B.

## 10. MARKING

**10.1** The name, initials or trade-mark of the manufacturer, cast number and type of the material shall be cast or otherwise legibly marked by stamping on each casting. In the case of small castings where it is difficult to cast-on or stamp all the details, the marking shall be as shown in the drawings or as agreed to between the purchaser and the supplier.

**10.1.1** The material may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## APPENDIX A

( Clause 0.3 )

### INFORMATION TO BE GIVEN BY THE PURCHASER

**A-1.** The following information should be given by the purchaser at the time of placing the order:

- a) Type of alloy ( *see 3.1* );
- b) Whether porosity test is required, if so, what shall be the method of test, test pressure, testing fluid, number of samples to be tested, etc ( *see 7* );
- c) Size and shape of casting ( *see 8.1* ); and
- d) Marking details for small castings ( *see 10.1 and 10.1.1* ).

## APPENDIX B

( Clause 9.1 )

### SAMPLING AND CRITERIA FOR CONFORMITY

#### B-1. LOT

**B-1.1** In any consignment all the castings of the same type ( *see 1.1* ) poured from the same melt shall be grouped together to constitute a lot.

## **B-2. WORKMANSHIP, FREEDOM FROM DEFECTS, SIZE AND SHAPE**

**B-2.1** Each of the castings in a lot shall be inspected for workmanship ( *see 5* ), freedom from defects ( *see 6* ), and size and shape ( *see 8* ). Defectives encountered shall be removed and only the remaining castings shall be accepted.

## **B-3. CHEMICAL COMPOSITION**

**B-3.1** The requisite quantity of material from any one of the castings in a lot shall be subject to chemical analysis ( *see 3* ).

**B-3.2** The lot shall be considered as conforming to the chemical requirements of this specification if the results of testing of the sample for each of the chemical characteristics satisfy the corresponding requirements given in 3. If the test result fails to satisfy the requirements for any of the characteristics, 2 more tests for that characteristic shall be done from the same sample in order to confirm that the analysis has been done properly. If both of the test results satisfy the relevant requirements given in 3, the lot shall be considered as conforming to the chemical requirements of this specification, otherwise not.

## **B-4. MECHANICAL PROPERTIES**

**B-4.1** The mechanical properties specified in 4 shall be determined at the rate of 1 for every 100 castings or part thereof from a lot, subject to the condition that a maximum of 10 determinations need be done for a single lot.

**B-4.1.1** When only one determination is done on a lot for mechanical properties, the lot shall be considered as conforming to the mechanical properties of this specification if the result so obtained satisfies the corresponding requirement given in 4. If the sample fails in any of the mechanical properties then 2 additional determinations from the same lot shall be done in order to confirm that the test has been done properly. If both of these test results satisfy the relevant requirements given in 4, the lot shall be considered as conforming to the particular mechanical property under consideration otherwise not.

**B-4.2** When there are more than one determinations of mechanical properties for a lot, the lot shall be considered as conforming to the requirements of this specification if the mean and the range calculated from the test results for each of the mechanical properties specified in 4 satisfy the relevant conditions given below:

- a) The value of the expression ( mean + 0.6 range ) shall be less than or equal to the corresponding maximum specification limit, and
- b) The value of the expression ( mean - 0.6 range ) shall be greater than or equal to the minimum specification limit.

# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Conversion
Force	newton	N	1 N = 1 kg. 1 m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s ( s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

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